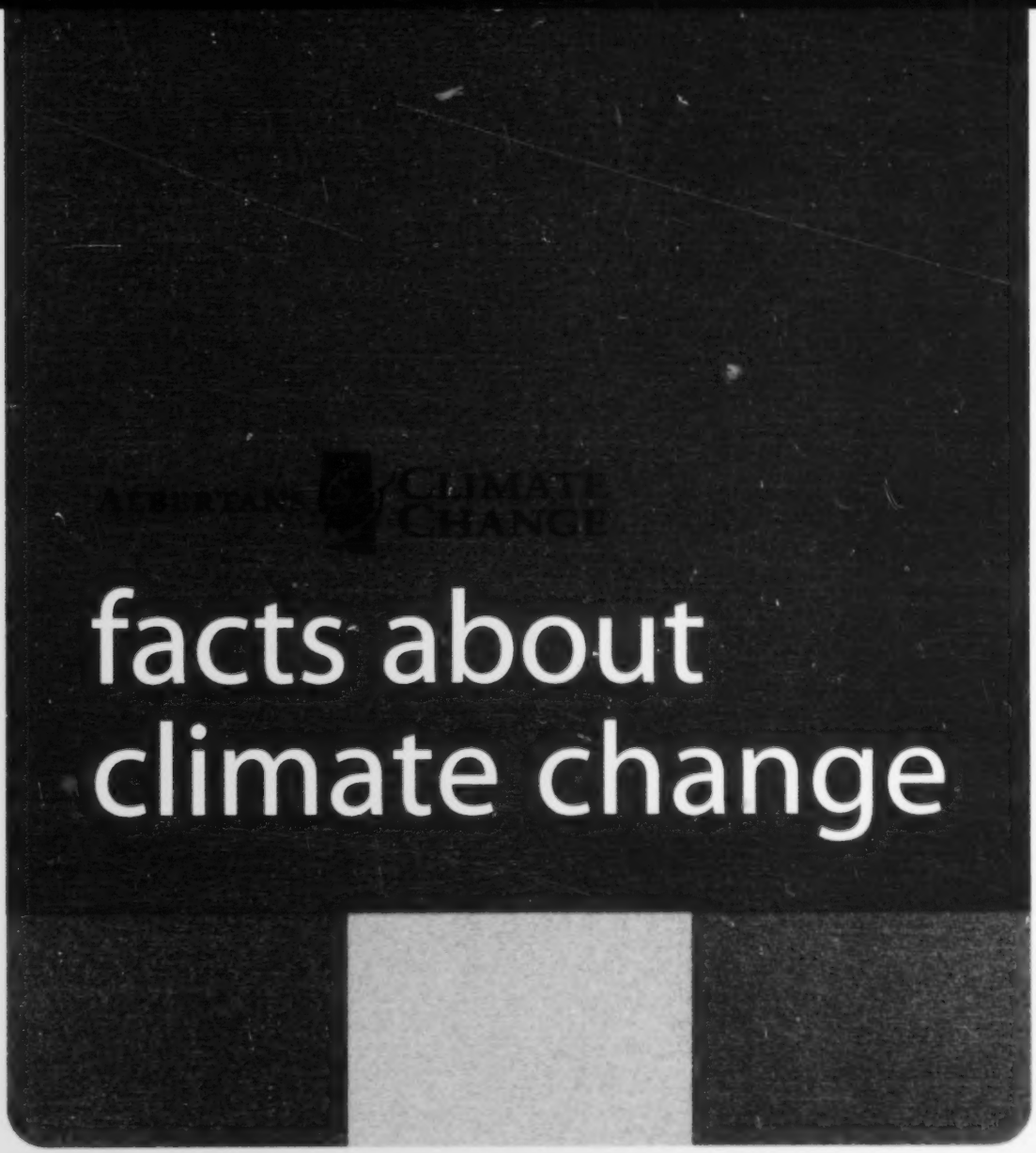

Alberta

We have both a responsibility and an opportunity to take a leadership role in climate change and to develop solutions that are unique to our province.

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climate change considerations

Pick up a newspaper, listen to the radio or watch television and rarely will a day go by when there isn't a story about climate change and its impact on different parts of the world.

Stories range from predictions of dire consequences in the not-too-distant future to positive messages about what people can do to reduce their own use of energy.

The **Intergovernmental Panel on Climate Change** is a United Nations group that includes more than 3,000 scientists around the world. The Panel issues comprehensive report cards on climate change. Visit www.ipcc.ch.

While some aspects of climate change have been controversial in the past, scientists around the world who sit on the Intergovernmental Panel on Climate Change now agree on these key points:

> Climate change is real. Our planet is warming and it's doing so at a faster pace than at any other time in our recorded history.

> It's very likely that human activities are to blame for most of the warming in the past 250 years.

> While the impact of climate change takes place over many years, we are seeing the impact of higher global temperatures now and, as temperatures continue to increase in the coming years, we will see more heat waves, floods, droughts and rising sea levels.

So what does all that mean for Alberta?

Important steps are already underway. We implemented a Climate Change Action Plan in 2002 and established Climate Change Central to do education and outreach. In addition, Alberta introduced the first legislation in Canada for regulating greenhouse gas emissions, set a requirement for large industrial emitters to report on their emissions and followed that up in 2007 with a specific emissions reduction target for industry. Important steps are also being taken by municipalities, industry leaders, researchers and individuals and there are many promising results.

At the same time, Alberta depends on burning fossil fuels to generate electricity and to meet the demands for oil and gas in the rest of Canada and North America. And that means our emissions of greenhouse gases are the highest in the country. It also means we have both a responsibility and an opportunity to continue to take a leadership role in addressing climate change and to develop solutions that are unique to our province.

Our 2002 action plan is almost complete and we need to look ahead to the next steps. As we move forward, Albertans will have an opportunity to contribute to future plans for addressing climate change in Alberta.

Albertans and Climate Change: Taking Action was released in 2002 and outlined ways to reduce greenhouse gas emissions in the province. This plan focused on improving energy efficiency, enhancing use of technology, seeking out new environmentally friendly sources of energy, and better managing our emissions. To view the plan and actions taken go to www.gov.ab.ca/env/climate/plan.html.

WHAT IS CLIMATE CHANGE?

Aside from the odd cold snap, this year Alberta has enjoyed sunny skies and a relatively warm winter. In other parts of Canada there have been some surprises. There's not much snow in eastern Canada and Vancouver has suffered through one devastating storm after another.

Is this climate change in action?

Maybe. But as tempting as it is to point to major storms or unusual weather and say it's because of climate change, in fact, climate change takes place over a long period of time. And you can't point to any particular change in the weather and say: that's because of climate change.

What's the difference between weather and climate?

People often confuse the two terms. Weather refers to the temperature, precipitation, wind and humidity over a few hours or days. Climate looks at changes in these same factors but over a long period of time. To put it simply, climate is what you expect and weather is what you get.

That's why it's important to remember the difference between weather and climate.

Weather is what we see on a day-to-day basis. What's the temperature? Is it supposed to rain or snow? How windy will it be and will it be a humid or a typically dry Alberta day? Put that all together and that's weather.

Climate takes a much longer view. It looks at average weather over at least 30 years. So, for example, if the amount of snow we get over thirty years is lower than the amount we had in the previous thirty years, that's a change in our climate. If we see more serious weather events – like storms and hurricanes and unusual temperatures – not just one year but over a long period time, that could reflect a change in the climate. Year-over-year changes are just normal variations in weather – the kind we've all seen over many years.

Climate change is not new. Evidence going back millions of years shows the Earth's climate has gone through a number of changes. The reason we're hearing more about climate change now is that there are very real signs that the Earth's climate is changing at a far more rapid pace and much of that is due to human activities. Average temperatures around the globe are increasing. In the next 100 years, the average temperature could increase by a range of 1.1 to 6.4 degrees Celsius depending upon actions taken – the most rapid and profound change in temperature the Earth has experienced in the last 10,000 years.

WHAT CAUSES CLIMATE CHANGE?

Climate change can be caused by a number of factors such as changes in the Earth's orbit, volcanoes, or changes in the energy from the sun. Greenhouse gases also have an important effect on the Earth's temperature. They trap heat in the atmosphere and cause global temperatures to rise. This is called "the greenhouse effect."

Greenhouse gases include –

> Carbon dioxide
> Methane
> Nitrous oxide
> Hydrofluorocarbons
> Perfluorocarbons (PFCs)
> Sulphurhexafluoride (SF6)

Most of these gases (except hydrofluorocarbons, PFCs and SF6) occur naturally in our environment and together they make up less than one per cent of the Earth's atmosphere. Naturally occurring greenhouse gases are essential for our survival. They act like a blanket around the Earth, trapping heat in the lower layer of the Earth's atmosphere and preventing most of it from escaping into space.

Without these greenhouse gases, the Earth would be about 30 degrees colder. It would be a cold and barren place with no water and life as we know it would not exist.

The problem comes with a substantial increase in greenhouse gases and what this does to the greenhouse effect. The majority of greenhouse gas emissions caused by human activity come from the use of fossil fuels including coal, oil and gas. When we drive our cars, run our furnaces and light our homes, we emit greenhouse gases. Our industries release emissions when they extract and refine fossil fuels, create electricity and manufacture products. Burning fossil fuels produces emissions of three main greenhouse gases – carbon dioxide, methane and nitrous oxide. Each year, human activities throughout the world add more than seven billion tonnes of greenhouse gas into the atmosphere.

The term **carbon sinks** refers to oceans, forests and other vegetation that naturally absorb carbon dioxide from the air. If one of these absorbs more carbon than it gives off, it is called a sink, while a carbon source emits more than it absorbs.

Farming activities and changes in the way land is used also add carbon dioxide, methane and nitrous oxide to the atmosphere. Forests and wetlands can play an important role as carbon sinks by absorbing and removing carbon dioxide from the atmosphere. Removing forests and wetlands can alter the balance since fewer greenhouse gases are absorbed and more are released to the atmosphere.

As more greenhouse gases are pumped into the atmosphere, more heat is trapped and average temperatures rise. Scientists now agree that human activity is most likely responsible for most of the increases we've seen in the Earth's temperature over the past 250 years.

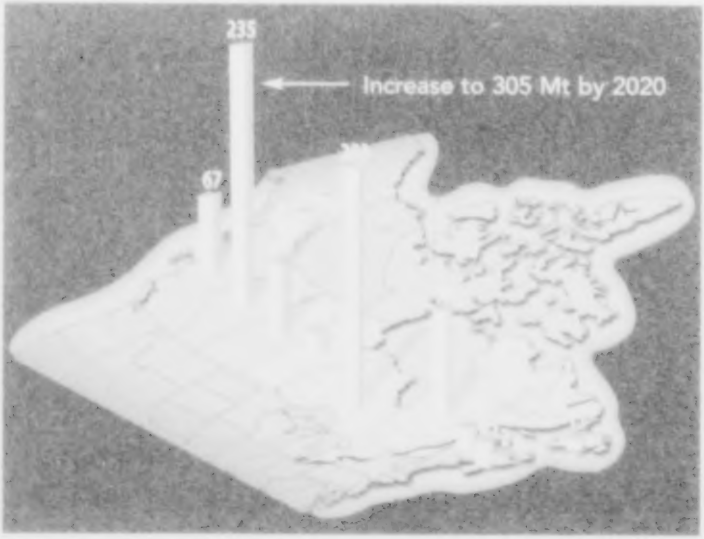
The biggest concern is the speed at which these changes are happening. Carbon dioxide is the main concern and information shows that the atmospheric levels of carbon dioxide are increasing over 10 per cent every 20 years. If emissions continue to grow at current rates, the levels of carbon dioxide in our atmosphere will almost certainly double during the 21st century and it's possible they could triple.

WHAT ROLES DO CANADA AND ALBERTA PLAY?

If we look at the leading emitters of carbon dioxide around the world, Canada ranks 7th overall. With roughly one half of one per cent of the world's population, Canada is responsible for approximately two per cent of the world's total emissions of greenhouse gases.

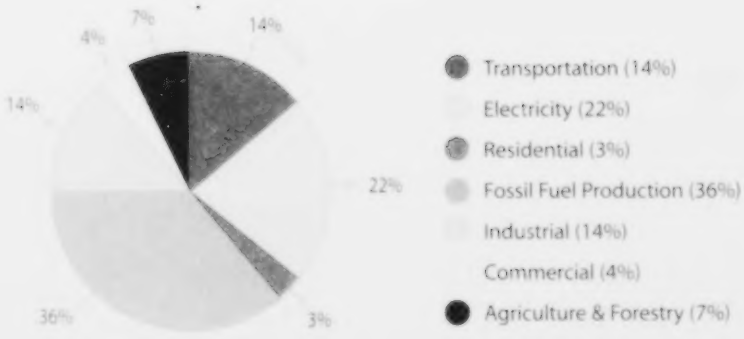
A third of Canada's greenhouse gas emissions come from Alberta and these emissions are predicted to increase by another third in the next five to ten years. This is largely because Albertans are reliant on coal-fired electricity generation and because of our role as the leading energy producer in Canada.

National Emissions Profile (Mt CO_2e)



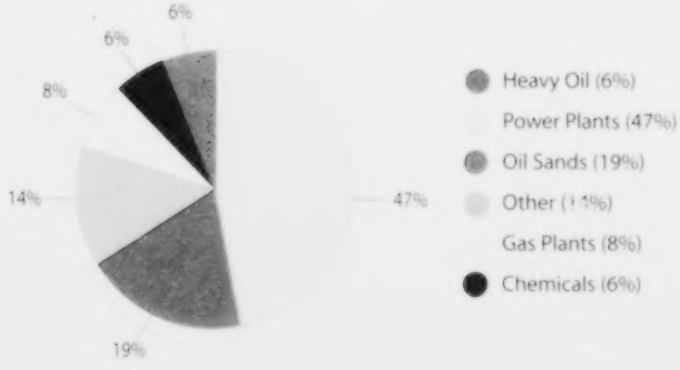
Where do Alberta's emissions come from?

Alberta's greenhouse gas emissions in 2004 were 235 megatonnes (1 million tonnes). These emissions come from all sectors of the economy. The largest portion of our emissions come from producing fossil fuels (oil, gas, coal) and electricity. The balance of the emissions come from a number of sectors including residential, commercial, agriculture, forestry and transportation (see pie chart below).



Large industrial facilities that emit more than 100,000 tonnes of carbon dioxide annually are required to report their emissions every year. In 2005, these large facilities emitted 109 megatonnes. The largest emitters of carbon dioxide in the province were power plants, many of which burn coal and natural gas to produce electricity, along with oil sands facilities and gas plants (see pie chart below).

Alberta's Large Industrial GHG Emissions (2005)



Alberta developed Canada's first **specified gas reporting program** for large industrial facilities. Facilities that emit a minimum of 100,000 tonnes of greenhouse gases are required to report their emissions annually. The current report can be found at www.gov.ab.ca/env/air/documents/2004_AB_GHG_Report.pdf

Even though these emissions come from energy and electricity facilities, the amount of energy and electricity produced is tied directly to consumer demand not only here in Alberta but also across Canada and, in the case of energy, in international markets.

Since 1990, total greenhouse gases emitted in Alberta have increased by 40 per cent. All other provinces and territories (except Yukon) have seen increases in greenhouse gas emissions since 1990. Alberta's is the third largest increase behind Saskatchewan (62 per cent) and New Brunswick (47 per cent).

WHAT IS THE IMPACT OF CLIMATE CHANGE?

We know that greenhouse gases contribute significantly to climate change and that Alberta is the largest emitter in Canada. But the key question is: what is the impact on our environment and the rest of the world?

Signs of climate change are evident

Climate change is a long-term process, but scientists agree the earth is warming and we are seeing the impact today.

Here are some examples of current evidence of climate change:

- Almost all mountain glaciers outside of the polar regions retreated during the 20th century and many are retreating at increasing rates.
- Changes can be seen in the normal patterns for many types of plants and animals from changes in the growing season to changes in where plants and animals are able to live. For example, butterflies, dragonflies and some other insects are now able to live in more northern parts of the world where before, it was too cold.

> There is a trend toward more powerful storms, wider swings in weather, and hotter, longer dry periods. Scientists suggest that the increase in extreme weather events – like cyclones, hurricanes, more frequent and intense floods and droughts – is "too pronounced to explain away as random."

> The average sea level rose by 10 to 20 cm during the 20th century. Higher temperatures cause the ocean's volume to expand, and melting glaciers and ice caps add more water.

> Temperatures in the Arctic increased by about five degrees Celsius during the 20th century. The total area covered by frozen ground in the Northern Hemisphere decreased by seven per cent in the last century. The top level of permafrost, which covers almost half of Canada, has warmed by three degrees Celsius since the 1980s. The length of time rivers and lakes are covered with ice dropped by about two weeks during the 20th century.

The future impact is difficult to predict

Predicting the future impact is not nearly as easy as tracking trends from the past and assessing what we see today. As a result, there are wide variations in future scenarios analysing what could happen as a result of climate change. We know there will be an impact. What we don't know for sure is what the specific changes will be, what impact they will have, how serious the impact will be and how quickly it will happen.

Climate change could have both positive and negative impacts on the way we live and work. On the positive side, higher temperatures in the more northern parts of the world could extend their growing season or allow new species of plants, animals and fish to survive where it would not have been possible before.

Higher levels of precipitation could boost agricultural productivity in some areas and decrease it in others. However, most suggest that on a global basis, the longer term impacts will be much more negative. These shifts will test our ability to adapt to a changing environment.

Generally, experts agree that:

> By 2100, global temperatures could rise between 1.1 and 6.4 degrees Celsius depending upon actions taken. This could mean that the Greenland ice sheet disappears over millennia if current melting continues.

> By 2100, sea levels are forecast to rise by about one third of a metre. This would have a serious impact on coastal areas including the Mackenzie Delta in the Western Arctic, the Fraser Delta outside Vancouver, and the Atlantic provinces.

> More severe storms and floods are likely, especially in coastal areas. The Intergovernmental Panel on Climate Change forecasts there will be 10 to 40 per cent more intense storms by the end of this century.

> Some parts of the globe will become drier, with more prolonged droughts.

> Most of the world's endangered species may become extinct as a result of warmer conditions in forests, wetlands and rangelands. Warming of two degrees could leave 15 to 40 per cent of species facing extinction.

> Higher temperatures could expand the range of some dangerous diseases such as malaria.

> All countries will be affected by climate change, but the poorest countries will suffer the earliest and the most – partly because they will see the largest impact of climate change (coastal areas and parts of Africa) and partly because they don't have the resources to adapt to changes in food and water supplies.

What impact can we expect in Alberta?

Again, it is difficult to answer this question with certainty. Scientific evidence and current trends suggest that the following scenario is the most likely in the longer term.

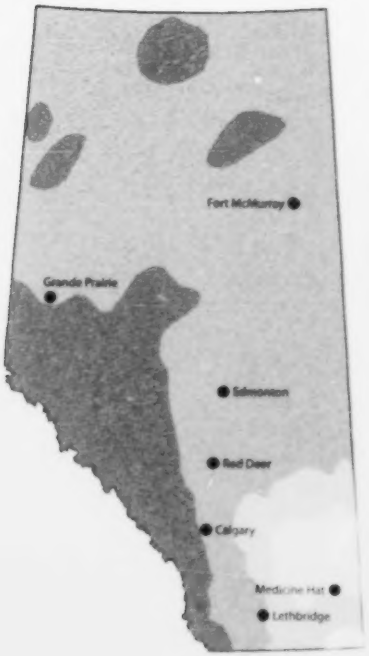
Generally, Alberta will see a reduction in surface water and soil moisture. This could pose serious problems for agriculture, forestry, municipalities and industry. However, increased levels of carbon dioxide could be beneficial to plants and could help make them more drought tolerant. Southern Alberta will experience reduced moisture supplies and drier conditions (see maps on page 14).

Mountain and northern regions and the boreal forest will face increasing threats from wildfires, insect invasions, decreasing soil moisture and changes to the ecosystem – all of which could affect the forestry industry and biodiversity. Some native species will decline or disappear entirely while other species, both native and from outside Alberta, will increase in numbers or their geographic distribution. These changes will be most visible in mountain ecosystems, isolated forests (e.g. Cypress Hills), and the fringes of the foothills and boreal forests.

Fort McMurray
Grande Prairie
Edmonton
Red Deer
Calgary
Lethbridge
Most Moist
Least Moist

Annual Moisture Index

1961-1990



2050s

Most Moist

Least Moist

Scenarios have been used to predict potential changes to climate in Alberta. These maps show the possible changes to moisture levels. Note the increasing area of least moisture in the south of the province.

Shorter winters bring a longer growing season and the opportunity to grow a more diverse range of plants and crops where water supplies are available (see maps on page 17). On the other hand, shorter winters will limit winter recreation. Ice roads in northern Alberta will become less available, and for shorter periods of time. Shorter winters could also decrease the working season for oil and gas and forestry industries that rely on frozen ground and muskeg to operate. Changes in the mountain snow pack and glaciers may limit the water available to downstream communities.

Overall, we can expect warmer temperatures, decreased supply of water and net moisture, more frequent forest fires, an increased threat of insects and diseases, and more extreme seasonal weather changes.

As part of its climate change plan, Alberta and its partners commissioned a study* on the potential impact of climate change in the province.

Looking ahead, scenarios in the study suggest that:

> By the 2050s, temperatures in Alberta will be three to five degrees higher than today.

> By the 2080s, the temperatures in Grande Prairie and Fort McMurray will be similar to or higher than the temperatures we see today in Lethbridge and Medicine Hat.

> The number of days with temperatures above five degrees will increase by 30 to 50 per cent, resulting in a longer growing season.

*Climate Scenarios for Alberta. A report prepared for the Prairie Adaptation Research Collaborative in Cooperation with Alberta Environment. Elaine Barrow & Ge Yu. May 2005. Available at www.parc.ca/research_pub_scenarios

> While annual precipitation will increase, the summers will be drier, especially in southern Alberta. By the 2080s, Calgary, Edmonton, Grande Prairie and Fort McMurray will have annual shortages of moisture similar to what we currently see in Lethbridge and Medicine Hat.

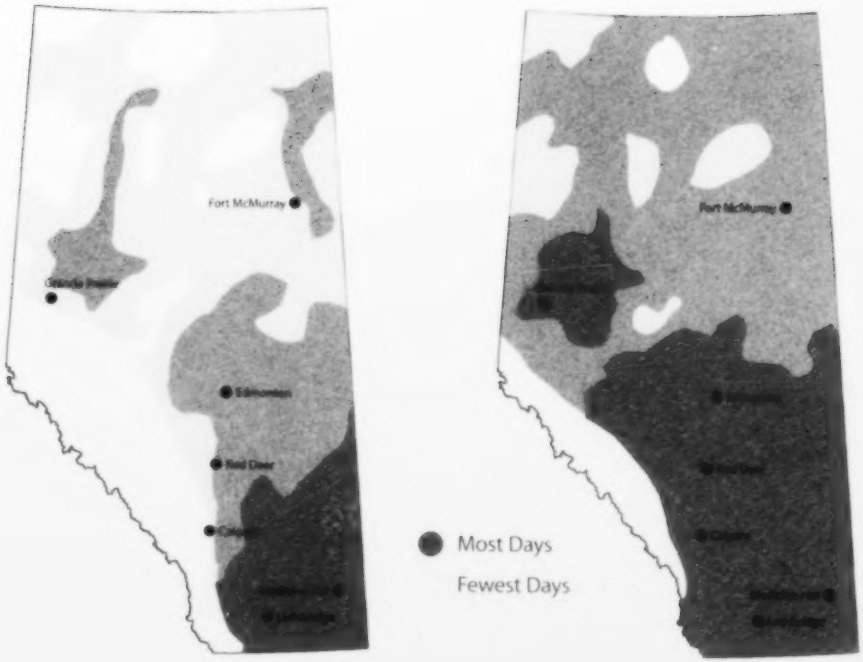
Perhaps the biggest impact will be on our supply of water. Current studies predict a reduction in the level of prairie lakes. The same applies to Alberta's rivers where a combination of higher temperatures and no increase in precipitation is causing lower streamflows.

The impact of these trends will be felt in all parts of the province and on all sectors of our economy. There also will be direct effects on Alberta's ecosystem and a wide range of plants, animals, fish and birds.

Growing Degree Days Above 5°C

1961-1990

2050s



Climate change does have some potential positive effects. These maps compare the average length of the growing season over the period 1961 to 1990 with the potential growing season in 2050. The map on the right shows a longer growing season for most of the province.

We can take steps to adapt

Climate change occurs over decades and we don't know for certain what will happen. The impacts we're seeing today are the result of a combination of factors occurring over many years in the past. And the impact of the actions we take today may not be felt for many years to come. A report of the Intergovernmental Panel on Climate Change concluded that significant warming will continue for centuries "even if greenhouse gas concentrations were to be stabilized." However, this shouldn't stop us from acting. We need to identify and move forward with reasonable measures that will decrease future risks.

While we can't turn things around in the short term, actions can be taken to adapt to changes we're seeing today and are likely to see in the future. This gives us opportunities to act now, reduce our impact and develop new technologies for energy use.

Typically, these are called "adaptation" strategies. They involve taking steps to adapt to a changing climate, manage short- and longer-term risks and take advantage of opportunities to build a more sustainable environment.

Adaptation strategies start with a clear understanding of the impact of climate change today and how vulnerable we are to potential changes in Alberta's climate.

The next step is to determine what can be done now to adapt to and reduce some of the negative impacts and also to develop new technologies and approaches which not only would be beneficial in Alberta but could be marketed or shared around the world.

Some examples of adaptation strategies include:

> Developing crops that are more resistant to drought and introducing crops from other regions that are more suitable for a changed climate.

> Investing in research on new technologies.

> Exploring ways of reducing the use of water in key industries including the energy industry and agriculture.

> Putting land use policies in place to preserve wetlands and natural areas.

> Reviewing our standards for buildings, roads and highways to ensure they will withstand challenges caused by a changing climate and climate extremes.

> Designing buildings and communities that are energy efficient.

what is alberta doing to manage and reduce emissions?

Examples of Actions Taken by Albertans

- Through a student/teacher initiative, Cochrane High School has installed solar panels and a wind turbine to help provide its electricity.
- Incentive programs have encouraged Albertans to remove over 1,200 high-polluting vehicles from the streets of Edmonton and Calgary and to replace 5,900 old furnances with energy efficient models.
- Alberta companies and institutions are leading initiatives to minimize the impact of burning coal – Luscar is combining coal with paper waste to see if it reduces emissions.
- Municipalities have received more than $30 million in interest-free loans for 60 projects that will make their buildings more energy efficient.

Positive things are being done already in Alberta. The provincial government's climate change plan (*Albertans and Climate Change: Taking Action, 2002*) has guided our actions to address greenhouse gas emissions. The action plan uses a multi-pronged approach, recognizing there is no one solution to managing emissions. It highlights the need to take immediate action, work collaboratively with partners and make strategic investments that address climate change while continuing to develop a competitive economy.

The action plan established an emissions intensity target to drive action. The target set was to reduce emissions intensity by 50 per cent below 1990 levels by 2020. An interim target of achieving a 30 per cent reduction in emissions intensity by 2010 was also set. As a result, by 2004 Alberta's emissions intensity decreased by 16 per cent from the 1990 levels, but total emissions have increased by 40 per cent. This means that while Alberta's economy is growing, steps have been taken to reduce the growth in emissions.

THE ROLE OF TECHNOLOGY

Technology is a key element in Alberta's action plan. The Alberta government has been supporting research to develop technologies that, over the long term, will reduce emissions and improve energy efficiency. By developing the technology here Alberta can make a global contribution to this issue and provide the opportunity to market to the rest of the world.

Research organizations like the Alberta Research Council, in partnership with universities and others, are doing innovative work to develop the next generation of technologies to reduce emissions.

For example, the Alberta Energy Research Institute is working on turning municipal solid waste into hydrogen, developing cleaner burning coal and determining how to use Alberta's geothermal energy. A network of more than 100 organizations from government, industry, the research community and non-government organizations is working to integrate climate change and energy innovation. This is a key area where Alberta has an opportunity to be a global leader and to market innovative solutions to the rest of the world.

The action plan also identified carbon capture and management as a critical technology. Using this technology, carbon dioxide is captured, compressed, transported and injected into depleted oil and gas reservoirs, coal seams and salt beds. It is a particularly important technology for Alberta. We have large sources of emissions and a favourable geology for storing carbon dioxide. The technology can also be used to enhance oil and gas recovery and, at the same time, reduce the amount of water that needs to be used. A few pilot projects are in place in Alberta, supported by a royalty credit program. The technology currently is used on small-scale operations but in the future has potential to be applied on a large scale.

As part of our climate change action plan, Alberta has also invested in technology that burns coal cleanly to generate electricity. This approach (called "coal gasification") is more efficient than conventional coal-fired processes and consequently it produces fewer greenhouse gases. The technology is also well suited to significantly reduce emissions of the pollutants that cause smog and soot, including nitrous oxides, sulphur oxides, particulate matter, and mercury. Other benefits include reducing, by about half, the cost of adding carbon capture and management and the near elimination of toxic solid waste due to the efficiences in the engineering design. Gasification technologies are being proposed in the Fort McMurray and Fort Saskatchewan areas.

Examples of Actions Taken by Albertans (continued)

- The Alberta government has completed energy improvements on all 200 government-owned facilities. Since 1990, the Alberta Government has cut its greenhouse gas emissions by approximately 50 per cent and saved taxpayers $6 million a year as a result of retrofitting government buildings.
- Ten new schools in Alberta will exceed new energy efficiency standards, including one in Vulcan which will be the one of the most energy efficient schools in Canada.
- Over 7,000 exit signs have been replaced with LED exit signs in multi-residential housing.

STEPS TAKEN TO REDUCE EMISSIONS

Energy conservation and efficiency have also been a focus in Alberta. Climate Change Central was established to help Albertans reduce their own emissions. A goal of Climate Change Central is to make Albertans more aware of the amount of energy they use and encourage them to take steps to make their homes energy efficient, change vehicles or use public transit.

Albertans are taking advantage of renewable and alternative energy. Alberta currently produces more wind power than any other province. Ninety per cent of electricity used in provincial government operations comes from green power sources. A $239 million provincial program to help develop bio-energy has been announced. A group of Alberta experts are exploring ways of taking further advantage of renewable and alternative energy.

The provincial government also introduced the first legislation in Canada specifically aimed at addressing climate change. *The Climate Change and Emissions Management Act* is Alberta's primary legislation for regulating greenhouse gas emissions in the province. Regulations have also been announced that set emissions intensity reduction targets for power plants, oil sands and other large-scale industrial facilities. These targets will apply effective July 1, 2007.

There may be times when a facility is unable to reduce emissions because it's not physically or technically possible or it is too costly. In those cases, the provincial government is allowing parties to invest in other projects in Alberta that reduce – or offset – emissions on its behalf.

Options could include investing in a farming operation that adopts tillage practices that release fewer greenhouse gas emissions than standard practices, or investing in a wind turbine that replaces electricity generated by fossil fuels. These offset reductions are then verified to ensure the emissions reductions are real. In effect, the emissions of one facility are "offset" by the actions of another project to reduce emissions.

Important steps are being taken in Alberta to address the challenges of climate change. Now that work on our initial climate change action plan is completed, it's time to plan ahead and decide what the next steps should be. What goals do we expect to achieve? What actions should we take and what technologies should we consider? What steps are individual Albertans prepared to take?

Answers to these important questions will set the stage for the next Alberta plan for continuing to tackle climate change and reducing greenhouse gas emissions.

NOTES

What future steps need to be taken?

We need to find ways to continue to reduce and manage our emissions and prepare to adapt to the changes in climate.

For more information about what is being done to address climate change, go to www.alberta.ca

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